

NSF 23-532: Design for Environmental Sustainability in Computing (DESC)

Program Solicitation

Document Information

Document History

- **Posted:** December 14, 2022

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National Science Foundation

Directorate for Computer and Information Science and Engineering
Division of Computing and Communication Foundations
Division of Information and Intelligent Systems
Division of Computer and Network Systems
Office of Advanced Cyberinfrastructure

Full Proposal Deadline(s) (due by 5 p.m. submitting organization's local time):

March 17, 2023

Type I and Type II projects

September 13, 2024

Type I and Type II projects

September 12, 2025

Type I and Type II projects

Full Proposal Deadline(s) (due by 5 p.m. submitting organization's local time):

Proposals Accepted Anytime

Type III projects



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Important Information And Revision Notes

Although proposal submissions to the Type III project type are "Accepted Anytime", Research.gov requires a "due date" and displays one for you to select. You can choose the any listed deadlines in Research.gov from the Due Date drop down window to submit to the Type III project type. Type I and Type II project proposals must be submitted to the applicable deadline date.

Any proposal submitted in response to this solicitation should be submitted in accordance with the *NSF Proposal & Award Policies & Procedures Guide (PAPPG)* that is in effect for the relevant due date to which the proposal is being submitted. The NSF PAPPG is regularly revised and it is the responsibility of the proposer to ensure that the proposal meets the requirements specified in this solicitation and the applicable version of the PAPPG. Submitting a proposal prior to a specified deadline does not negate this requirement.

Summary Of Program Requirements

General Information

Program Title:

Design for Environmental Sustainability in Computing (DESC)

Synopsis of Program:

The goal of the Design for Environmental Sustainability in Computing (DESC) program is to address the substantial environmental impacts that computing has through its entire lifecycle from design and manufacturing, through deployment into operation, and finally into reuse, recycling, and disposal. These

impacts go well beyond commonly-considered measures of energy consumption at run-time and include greenhouse warming gas emissions (GHGs), depletion of scarce resources like rare earth elements, and the creation of toxic byproducts. For instance, *embodied* energy, GHGs, and other harmful emissions from manufacturing computing systems can often be higher than the *operational* energy and resulting GHGs and harmful emissions systems will use and emit during their lifetime. Data centers can directly impact local ecosystems through heat management practices, as well as impacting local power management and capacity. Algorithmic, software, and workflow design choices; design of operating systems and middleware; and choices of programming languages and compilation can drive environmental impacts from provisioning, use, and effective lifetimes of computing. Moreover, decisions about maintenance, repurposing and disposal of computing systems shape those impacts by affecting the need for additional systems manufacturing and disposal, the latter of which impacts contamination and consumption of landfill space.

The DESC solicitation seeks to bring together teams to work toward solutions that address sustainability in new and measurably different ways that are inclusive of the breadth of computing and information science and engineering research, with the ultimate goal of *holistic order of magnitude improvements in the environmental sustainability of computing*. DESC projects should *go beyond solely energy efficiency* to address a more complete set of environmentally sustainable outcomes in terms of (but not limited to) metrics of GHGs, volatile organic compounds (VOCs), consumption and disposal of rare materials, heat, wastewater, recyclability, and longevity, along with potential interactions between these metrics.

DESC seeks novel approaches that address and raise environmental sustainability to a first-order system objective along with performance, energy-efficiency, security, and other common concerns, at all layers of system stacks and all steps in their lifecycles. Novel hardware and network architectures, sustainability-aware algorithms and data management tools, and methods for software and system design that support assessing and encouraging environmental sustainability are all needed. Approaches to sustainably manage increasingly large datasets and workloads are crucial as are techniques to enhance computing capabilities while consuming fewer resources. Improved modeling and methodologies for organizational and end-user decision making around adoption, use, repurposing, and ultimately disposal of computing systems are also needed.

Together, DESC proposals should seek to push the boundaries of system design and when possible seek ways to align sustainability with other metrics to increase both environmental sustainability and computing capabilities as well as the net benefit that computing brings to society.

DESC seeks to fund research that addresses environmental sustainability beyond energy efficiency alone. Purely performance and/or energy efficiency computing proposals, proposals that seek to use computing to advance sustainability of other sectors are not in scope for DESC. Additionally, given there are traditionally three pillars in sustainability research, DESC is focused on environmental sustainability. Proposals that seek to solely advance the economic and/or social pillars of sustainability are not in scope for this program.

Broadening Participation in STEM:

NSF recognizes the unique lived experiences of individuals from communities that are underrepresented and/or underserved in science, technology, engineering, and mathematics (STEM) and the barriers to inclusion and access to STEM education and careers. NSF highly encourages the leadership, partnership, and contributions in all NSF opportunities of individuals who are members of such communities supported by NSF. This includes leading and designing STEM research and education proposals for funding; serving as peer reviewers, advisory committee members, and/or committee of visitor members; and serving as NSF leadership, program, and/or administrative staff. NSF also highly encourages demographically diverse institutions of higher education (IHEs) to lead, partner, and contribute to NSF opportunities on behalf of their research and education communities. NSF expects that all individuals, including those

who are members of groups that are underrepresented and/or underserved in STEM, are treated equitably and inclusively in the Foundation's proposal and award process.

NSF encourages IHEs that enroll, educate, graduate, and employ individuals who are members of groups underrepresented and/or underserved in STEM education programs and careers to lead, partner, and contribute to NSF opportunities, including leading and designing STEM research and education proposals for funding. Such IHEs include, but may not be limited to, community colleges and two-year institutions, mission-based institutions such as Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), women's colleges, and institutions that primarily serve persons with disabilities, as well as institutions defined by enrollment such as Predominantly Undergraduate Institutions (PUIs), Minority-Serving Institutions (MSIs), and Hispanic Serving Institutions (HSIs).

"Broadening participation in STEM" is the comprehensive phrase used by NSF to refer to the Foundation's goal of increasing the representation and diversity of individuals, organizations, and geographic regions that contribute to STEM teaching, research, and innovation. To broaden participation in STEM, it is necessary to address issues of equity, inclusion, and access in STEM education, training, and careers. Whereas all NSF programs might support broadening participation components, some programs primarily focus on supporting broadening participation research and projects. Examples can be found on the NSF Broadening Participation in STEM website.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

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- Sylvia J. Spengler, Program Director, CISE/IIS, telephone: (703) 292-7347, email: desc@nsf.gov
- Ann C. Von Lehmen, Program Director, CISE/CNS, telephone: (703) 292-4756, email: desc@nsf.gov
- Goli Yamini, Program Director, CISE/CCF, telephone: (703) 292-5111, email: desc@nsf.gov
- Danella Zhao, Program Director, CISE/CCF, telephone: (703) 292-4434, email: desc@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.070 --- Computer and Information Science and Engineering

Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 12 to 18

Type I Small Projects: up to 10 awards will be made each year in FY 2023, FY 2025, and FY 2026, pending availability of funds and quality of proposals received.

Type II Large Projects: up to 2 awards will be made each year in FY 2023, FY 2025, FY 2026, pending availability of funds and quality of proposals received.

Type III Workshop Projects: up to 5 awards will be made each year in FY 2023, FY 2024, FY 2025, pending availability of funds and quality of proposals received.

Anticipated Funding Amount: \$11,800,000

Type I Small Projects: Up to \$600,000 per award with duration up to 3 years

Type II Large Projects: Up to \$2,000,000 per award with duration up to 4 years

Type III Workshop Projects: Up to \$100,000 per award with duration up to 1 year

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds and quality of proposals received.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

By the submission deadline, any PI, co-PI, or other senior/key project personnel must hold either:

- a tenured or tenure-track position, *or*
- a primary, full-time, paid appointment in a research or teaching position

at a US-based campus of an organization eligible to submit to this solicitation (see above), with exceptions granted for family or medical leave, as determined by the submitting organization. Individuals with *primary* appointments at for-profit non-academic organizations or at overseas branch campuses of US IHEs are not eligible.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 2

An investigator may participate as PI, co-PI, or Senior/Key Personnel in no more than two Type I project proposals, no more than one Type II project proposal, or no more than one Type I project and one Type II project proposal submitted to each deadline listed above.

There are no limits on Type III project proposals.

An investigator cannot be PI, co-PI, or Senior/Key Personnel on more than two Type I awards and one Type II award through the lifetime of this program from FY 2023 to FY 2026. There are no limits on Type III

projects.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. Any proposal that exceeds this limit at the time of submission for any PI, co-PI, or Senior/Key Personnel will be returned without review. **No exceptions will be made.** Proposals that are withdrawn prior to commencement of merit review, or those that are returned without review by NSF, will not count against this proposal limit.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
 - Full Proposals submitted via Research.gov: *NSF Proposal and Award Policies and Procedures Guide (PAPPG)* guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
 - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:**

Not Applicable
- **Other Budgetary Limitations:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitting organization's local time):
 - March 17, 2023
 - Type I and Type II projects
 - September 13, 2024
 - Type I and Type II projects
 - September 12, 2025
 - Type I and Type II projects
- **Full Proposal Deadline(s)** (due by 5 p.m. submitting organization's local time):
 - Proposals Accepted Anytime
 - Type III projects

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review criteria apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Standard NSF award conditions apply.

Reporting Requirements:

Standard NSF reporting requirements apply.

I. Introduction

Environmental impacts of computing techniques and technologies extend well beyond their energy consumption and require a holistic focus on broader sustainability. Negative impacts of greenhouse gas emissions, depletion of rare earth elements, and e-waste are exacerbated by the proliferation of computing throughout society and the treatment of computing systems as disposable commodities with planned obsolescence. Furthermore, environmental concerns range from the better-known carbon footprint from energy consumption in data centers to equally important concerns of embodied carbon¹, generation of methane, carcinogens, volatile organic compounds, and eutrophication, among others. Widespread use of compute-intensive techniques (e.g., block chain and artificial intelligence), the handling and moving of massive amounts of data, the rollout of next-generation edge networks, and the growth of smart devices all amplify the environmental concerns from this proliferation of computing. A new sustainable way of thinking about computing, across the full lifecycle -- including manufacturing, operation, and disposal -- is necessary to address the computing needs of the present without compromising the wellbeing of future generations.

The current transition to a post-Moore era is an opportunity to look well beyond *power efficiency* and make GHG and other sustainability metrics first-order concerns in computing. This requires a paradigm shift towards *design for environmental sustainability* that treats sustainability impacts as first-order metrics and on equal standing with performance, reliability, usability, and operational energy efficiency. It is critical to consider sustainability across multiple dimensions (emissions, pollution, renewable versus limited resource usage, embodied costs, supply-chain impacts, etc.) in every layer of the computing stack; across the computing and networking spectrum from high-performance computing to smart mobile devices; through decision making about computing from adoption, through use, and ultimately disposal; and in application to various sized communities from rural to urban environments. The DESC program seeks fundamentally new and disruptive research across all aspects of computing including foundations, algorithms, modeling, design, reuse, programming, data management, fault tolerance, operation, data management, graceful degradation and decisions about use cases of digital and computing-based technologies and their associated infrastructure.

The objective of the DESC program is to build a community of researchers who will work in an interdisciplinary fashion to develop the new abstractions, metrics, tools, algorithms, architectures, networks, workflows, and software systems, etc., for disruptive improvements in the sustainability of next-generation computing. The goal is to holistically improve environmental impacts of computing throughout the lifecycle. Often this will require approaches that cross the full hardware and software stack. This program is not designed to support proposals targeting only energy-efficiency, performance, or other traditional computing metrics.

II. Program Description

This solicitation seeks transformative, cross-disciplinary, and potentially clean-slate approaches to enable sustainability across all levels of the entire computing stack from hardware to networking to software applications to use. Proposals are encouraged to consider diverse notions of sustainability and propose suitable metrics for quantifying impact. Traditional

energy-efficiency and power-savings methods alone are not in scope for this program. Computing techniques for sustainability in other fields are also not in scope for this program. This solicitation seeks ambitious and forward-thinking proposals on DESC along multiple dimensions that go beyond energy efficiency alone.

Key challenges. The main goal of the DESC solicitation is to make measurable progress on these grand challenges in environmental sustainability in computing.

- **Applying principles of sustainable and lifecycle science to computing:** How can existing scientific methodologies for measurement, assessment, and optimization of environmental sustainability, broadly, best inform environmental sustainability for the computing spectrum?
- **Defining, measuring and optimizing computational sustainability:** What kinds of sustainability considerations and metrics beyond solely energy efficiency such as GHG emissions, pollution, e-waste, and cost of renewable energy should be considered in the design and programming of sustainable computing systems and the networks that connect them? What are the additional metrics? How can they be assessed? What are the right approaches and algorithms for their optimization?
- **Pushing the pareto-optimal boundary:** Rather than settling for *trade-offs* between sustainability, performance, and other first-order criteria, what methods can *collectively improve* both sustainability and other first order metrics, simultaneously?
- **Promoting design for environmental sustainability as a top tier goal:** What approaches (tools, methods, incentives, standards of practice) should be developed for the CISE community to elevate the priority of environmental sustainability alongside other computing goals? How do we incorporate sustainability into all levels of decision making for design, deployment, use, and decommissioning for computing?
- **Leveraging opportunities for sustainability across the computing continuum:** How can we support emerging efforts at some levels of the computing stack while promoting new efforts at heretofore relatively unaddressed levels of the stack to reach multiplicative goals in improvements for new environmentally sustainable computing systems? How can these principles be applied to different types of computing systems?
- **Avoiding planned obsolescence:** How can we promote new environmentally sustainable design thinking at the tail of Moore's law where dramatic improvements from technology scaling no longer make systems quickly obsolete? How do principles such as design for longevity, fault tolerance, graceful degradation, repurposing, reuse, upcycling impact how we design such hardware and software systems?

Below are some possible, non-exhaustive, topics of potential interest. These should be considered in the context of the challenges given above:

- New models and metrics for sustainability that are broader than energy efficiency, as well as methods to discover and obtain pareto-optimal points for tensions between measures of addressing sustainability and other considerations like performance, correctness, security, privacy, usability, and human and economic cost.
- Techniques for responsible advancement of data acquisition, organization, storage, precision, analysis, networking, and movement, as well as judicious use of resource-intensive techniques (e.g., machine learning, block chain, and encryption) to meet sustainability metrics while advancing compute capabilities.
- Design for reusability principles across some or all levels of the entire computing and network stack to avoid obsolescence and enable longevity for devices (e.g., smartphones, IoT), including modular design for updating, common product-line sharing, repurposing, or retrofitting sub-components, and effective recycling of eventually decommissioned devices.
- Sustainability-aware software/system abstractions, design methodologies, workflows, interfaces, programming languages, hardware/software cross-layer optimization, and optimizing compilers for sustainability metrics that increase usability without loss of efficiency.
- Advances in computer architectures including reconfigurable architectures, accelerators, non-von Neumann processing approaches, approximate computing, intermittent computing, and fault tolerance for improved sustainability that reduce resource usage and increase effective system lifetimes.

- Advances in sustainability-aware cyber-physical, IoT, edge, and cloud technologies including service-level agreements, scheduling, capacity planning and provisioning that use advancements in disaggregated computing and networking, effective integration with energy harvesting and renewable energy sources, reduction of secondary pollutants, and novel cooling concepts.
- Advances in hardware that include green VLSI-CAD, replacements beyond hybrid CMOS+X, and use of cleaner legacy fabrication techniques targeting sustainable next-generation processors for highest-performance application to mobile/edge/next generation computing and networking.
- Design of algorithms (including encryption, machine learning, and artificial intelligence) and workflows that incorporate environmental sustainability as a formal optimization criterion, going beyond energy-efficient algorithmic techniques while preserving high performance.
- Programming languages, frameworks, and tools that help in measuring sustainability metrics and assist in ensuring the sustainability of existing software systems through new principles of software development with sustainability as a first-class concern.
- Methods for considering how use context and stakeholder goals impact sustainability-related decisions around computing and network system design, adoption, deployment, use, and retirement; assessing how those decisions affect the environmental impact of computing; encouraging consideration of environmental sustainability in those decisions; and creating novel methods for environmentally sustainable computing that enable advancements in smart and connected communities that align with social equity and economic growth.

II.B. Description of Project Types

There are three types of research projects: Type I Small, Type II Large, and Type III Workshops. All projects are subject to the solicitation specific criteria which is designed to advance the research objectives of this program.

Type I Small Projects

The purpose of the Type I Small projects is to support research activities that can be accomplished within a three-year duration, typically led by 1-2 PIs.

Type I Small projects may also serve as the preliminary exploration that leads to a Type II Large submission. Successful Type I projects of this type should articulate the broad vision across the entire project duration (Type I and Type II) and how the Type I effort prepares for the Type II investment.

All Type I Small projects, even those intending to seek Type II funding in the future, must present a full-scale research project that will stand alone if Type II funding is not obtained.

Type I Small projects may have budgets up to \$600,000 for up to three years.

Type II Large Projects

The purpose of the Type II Large projects is to support more interdisciplinary and/or cross-layer efforts that may require larger teams of varying expertise and longer periods of effort to accomplish the research goals. It is incumbent on the PI to justify the scope of a Type II investment with less interdisciplinary or cross-layer efforts, otherwise the PIs are encouraged to consider a Type I project.

Type II projects may be supported by efforts from an existing or previous Type I Small (or other related award such as those from the [Design for Sustainability in Computing Dear Colleague Letter \(22-060\)](#)) to demonstrate readiness for a Type II Large project. However, Type I projects are *not required* in order to be eligible to submit a Type II project.

Type II Large projects may have budgets up to \$2,000,000 for up to four years.

Type III Workshop Projects

The purpose of Type III projects is to support workshops that will catalyze research activities and proposals in different areas of computing and information science within the scope of design for environmental sustainability in computing.

These efforts do not need to be tied to any specific future Type I or Type II project proposal; however it is envisioned that project teams from these workshops would consider submitting proposals after participating in the workshop.

Type III projects may have budgets up to \$100,000 for up to one year.

Type III project proposals must be prepared in accordance with the guidance for Conference Proposals contained in PAPPG Chapter II.F.

III. Award Information

Anticipated Type of Award: Standard Grant

Estimated Number of Awards: 12 to 18

Type I Small Projects: up to 10 awards will be made each year in FY 2023, FY 2025, and FY 2026, pending availability of funds and quality of proposals received.

Type II Large Projects: up to 2 awards will be made each year in FY 2023, FY 2025, FY 2026, pending availability of funds and quality of proposals received.

Type III Workshop Projects: up to 5 awards will be made each year in FY 2023, FY 2024, FY 2025, pending availability of funds and quality of proposals received.

Anticipated Funding Amount: \$11,800,000

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Type III Workshop Projects: Up to \$100,000 per award with duration up to 1 year

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

IV. Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.

Who May Serve as PI:

By the submission deadline, any PI, co-PI, or other senior/key project personnel must hold either:

- a tenured or tenure-track position, *or*
- a primary, full-time, paid appointment in a research or teaching position

at a US-based campus of an organization eligible to submit to this solicitation (see above), with exceptions granted for family or medical leave, as determined by the submitting organization. Individuals with *primary* appointments at for-profit non-academic organizations or at overseas branch campuses of US IHEs are not eligible.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or co-PI: 2

An investigator may participate as PI, co-PI, or Senior/Key Personnel in no more than two Type I project proposals, no more than one Type II project proposal, or no more than one Type I project and one Type II project proposal submitted to each deadline listed above.

There are no limits on Type III project proposals.

An investigator cannot be PI, co-PI, or Senior/Key Personnel on more than two Type I awards and one Type II award through the lifetime of this program from FY 2023 to FY 2026. There are no limits on Type III projects.

These eligibility constraints will be strictly enforced in order to treat everyone fairly and consistently. Any proposal that exceeds this limit at the time of submission for any PI, co-PI, or Senior/Key Personnel will be returned without review. **No exceptions will be made.** Proposals that are withdrawn prior to commencement of merit review, or those that are returned without review by NSF, will not count against this proposal limit.

Additional Eligibility Info:

Proposals submitted in response to this solicitation may not duplicate or be substantially similar to other proposals concurrently under consideration by NSF.

Proposals that are withdrawn prior to commencement of merit review, or those that are returned without review by NSF, will not count against this proposal limit.

V. Proposal Preparation And Submission Instructions

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Research.gov or Grants.gov.

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov. The Prepare New Proposal setup will prompt you for the program solicitation number.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov*. The complete text of the *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper

copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via Research.gov. PAPPG Chapter II.E.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.D.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

Proposal Type: For Type I Small Projects and Type II Large Projects the "Research" type of proposal should be selected. For Type III Workshop Projects the **"Conference" type of proposal should be selected.**

Proposal title: Proposal titles must begin with "DESC" followed by a colon and indicate the type of project, **"Type I", "Type II", or "Type III"**, followed by a colon, then the title of the project. For example, **DESC: Type I: Title** or **DESC: Type II: Title** or **DESC: Type III: Title**. If submitting a Type III project proposal, please note that if submitting via Research.gov, the system will automatically insert the prepended title "Conference" when the proposal is created.

For proposals submitted as part of a set of collaborative proposals, all participating institutions should use the same title, which should begin with "Collaborative Research:" for example, **Collaborative Research: DESC: Type II: Title**. Please note that if submitting via Research.gov, the system will automatically insert the prepended title "Collaborative Research" when the collaborative set of proposals is created. For proposals from PIs in institutions that have RUI (Research in Undergraduate Institutions) eligibility, the title should include the keyword RUI, e.g., **DESC: Type I: RUI: Title** or **Collaborative Research: DESC: Type II: RUI: Title**.

Project Summary: The Project Summary consists of an overview, a statement on the intellectual merit of the proposed activity, and a statement on the broader impacts of the proposed activity.

Please provide between 2 to 6 keywords at the end of the overview in the Project Summary. The keywords should describe the main scientific/engineering areas explored in the proposal. The keywords should be prefaced with "Keywords" followed by a colon, and the keywords should be separated by semi-colons. Keywords should be of the type used to describe research in a journal submission. They should be included at the end of the overview in the project summary and might appear, for example, as **Keywords: embodied carbon; formal logic; computer graphics; sensor networks; information visualization; privacy.**

Project Description:

Describe the research and education activities to be undertaken in **up to 15 pages for Type I project proposals, and up to 20 pages for Type II project proposals.** The workshop activities should be described in **up to 8 pages for Type III project proposals.**

This section should be completed according to the general guidelines detailed in the NSF PAPPG, including the requirement for a separate section labeled "Broader Impacts."

Proposal Budget:

It is expected that the PIs, co-PIs, and other team members funded by the project will attend a DESC PI meeting annually to present project research findings and capacity-building or community outreach activities. Requested budgets should include funds for travel to this annual event for at least one project PI. In addition, PIs of Type II projects are required to allocate funds for a kickoff meeting.

Supplementary Documents: In the Supplementary Documents Section, upload the following information where relevant:

1. List of Project Personnel and Partner Institutions (Note: In collaborative projects, for all project types, the lead institution should provide this information for all participants):

Provide current, accurate information for all personnel and institutions involved in the project. NSF staff will use this information in the merit review process to manage reviewer selection. The list should include all PIs, co-PIs, Senior/Key Personnel, funded/unfunded Consultants or Collaborators, Subawardees, Postdocs, and project-level advisory committee members. This list should be numbered and include (in this order) Full name, Organization(s), and Role in the project, with each item separated by a semi-colon. Each person listed should start a new numbered line. For example:

1. Mei Lin; XYZ University; PI
2. Jak Jabes; University of PQR; Senior/Key Personnel
3. Jane Brown; XYZ University; Postdoctoral Researcher
4. Raket Ademas; ABC Inc.; Funded Consultant
5. Maria Wan; Welldone Institution; Unfunded Collaborator
6. Rimon Greene; ZZZ University; Subawardee

2. Management and Coordination Plans for Type II projects (required):

Note: A Management and Coordination Plan is required for all Type II project proposals including those from a single institution. In collaborative proposals, the lead institution should provide this information for all participants.

Every Type II project proposal must contain a clearly labeled "Management and Coordination Plan" of up to 3 pages, which includes: 1) the specific roles of the PI, co-PIs, other senior/key personnel, and paid consultants at all organizations involved to demonstrate that the project personnel have distinct but complementary expertise at different levels of the of the computing continuum; 2) how the project will be managed across organizations and expertise; 3) identification of the specific coordination mechanisms that will enable cross-organization and/or cross-expertise scientific integration and achieve synergy within the team; and 4) pointers to the budget line items that support these management and coordination mechanisms.

If a Type II proposal does not include a Management and Coordination Plan of up to 3 pages addressing (1)-(4) above, that proposal will be returned without review.

3. Data Management and Sharing Plan (required for all project types):

Proposals must include a Supplementary Document of no more than two pages labeled "Data Management and Sharing Plan". This Supplementary Document should describe how the proposal will conform to NSF policy on the dissemination and sharing of research results.

For additional information on the Dissemination and Sharing of Research Results, see:

<https://www.nsf.gov/bfa/dias/policy/dmp.jsp>.

For specific guidance for Data Management and Sharing Plans submitted to the Directorate for Computer and Information Science and Engineering (CISE) see: https://www.nsf.gov/cise/cise_dmp.jsp.

4. Documentation of Collaborative Arrangements of Significance to the Proposal:

Any substantial collaboration with individuals not included in the budget should be described in the Facilities, Equipment and Other Resources section of the proposal and documented in a letter of collaboration from each collaborator. Such letters should follow the format instructions specified in the PAPPG. Collaborative activities that are identified in the budget should follow the instructions in Chapter II.E.3.

5. Other Specialized Information:

RUI Proposals: PIs from predominantly undergraduate institutions should include a Research in Undergraduate Institutions (RUI) Impact Statement and Certification of RUI Eligibility in this section.

No other Supplementary Documents, except as permitted by the NSF PAPPG, are allowed.

Submission Checklist:

In an effort to assist proposal preparation, the following checklist is provided as a reminder of the important items that should be checked before submitting a proposal to this solicitation. For the items marked with (RWR), the proposal will be returned without review if the required item is non-compliant at the submission deadline. Note that these are requirements unique to this solicitation; for other return without review requirements, refer to the PAPPG.

- (RWR) Type II project proposals must include a **Management and Coordination plan** (3-page limit) to be submitted as a Supplementary Document.
- (RWR) Eligibility criteria must be followed. (See Eligibility Information.)
- The last line of the overview section in the Project Summary should consist of the word "Keywords" followed by a colon and between 2-6 keywords, separated by semi-colons.
- (RWR) The page limit for the Project Description of Type I project proposals is 15 pages.
- (RWR) The page limit for the Project Description of Type II project proposals is 20 pages.
- (RWR) The page limit for the Project Description of Type III project proposals is 8 pages.

Proposals that do not comply with the requirements marked as RWR will be returned without review.

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Other Budgetary Limitations:

Budgets should include travel funds to attend one DESC PI meeting annually for the project PIs, co-PIs and other team members as appropriate from all collaborating institutions. PIs of Type II projects are required to allocate funds for a kickoff meeting.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitting organization's local time):

March 17, 2023

Type I and Type II projects

September 13, 2024

Type I and Type II projects

September 12, 2025

Type I and Type II projects

- **Full Proposal Deadline(s)** (due by 5 p.m. submitting organization's local time):

Proposals Accepted Anytime

Type III projects

D. Research.gov/Grants.gov Requirements

For Proposals Submitted Via Research.gov:

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparation For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 or e-mail rgov@nsf.gov. The Research.gov Help Desk answers general technical questions related to the use of the Research.gov system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: <https://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to Research.gov for further processing.

The NSF Grants.gov Proposal Processing in Research.gov informational page provides submission guidance to applicants and links to helpful resources including the NSF Grants.gov Application Guide, Grants.gov Proposal Processing in Research.gov how-to guide, and Grants.gov Submitted Proposals Frequently Asked Questions. Grants.gov proposals must pass all NSF pre-check and post-check validations in order to be accepted by Research.gov at NSF.

When submitting via Grants.gov, NSF strongly recommends applicants initiate proposal submission at least five business days in advance of a deadline to allow adequate time to address NSF compliance errors and resubmissions by 5:00 p.m. submitting organization's local time on the deadline. Please note that some errors cannot be corrected in Grants.gov. Once a proposal passes pre-checks but fails any post-check, an applicant can only correct and submit the in-progress proposal in Research.gov.

Proposers that submitted via Research.gov may use Research.gov to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF Proposal Processing And Review Procedures

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior

NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Leading the World in Discovery and Innovation, STEM Talent Development and the Delivery of Benefits from Research - NSF Strategic Plan for Fiscal Years (FY) 2022 - 2026*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.D.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.D.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and other underrepresented groups in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management and Sharing Plan and the Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

For Type I and Type II proposals, reviewers will be asked to:

- Comment on whether relevant notions of environmental sustainability are addressed.
- Comment on the how the sustainability vision will be attained as well as theoretically and experimentally evaluated.
- Comment on the definition of sustainability metrics and (1) their sufficiency to adequately reach beyond traditional performance and energy efficiency, (2) whether they can successfully capture the impact on the environmental sustainability of the proposed work, and (3) their ability to be quantified and used in evaluation.

For Type III proposals, reviewers will be asked to:

- Comment on the notions of environmental sustainability advanced by the workshop.
- Comment on the vision for advancing environmental sustainability both theoretically and experimentally.
- Comment on the potential for seeding new metrics, approaches, and research ideas in environmental sustainability for a discipline within CISE.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will generally be completed and submitted by each reviewer and/or panel. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements or the Division of Acquisition and Cooperative Support for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. Award Administration Information

A. Notification of the Award

Notification of the award is made to *the submitting organization* by an NSF Grants and Agreements Officer. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Administrative and National Policy Requirements

Build America, Buy America

As expressed in Executive Order 14005, [Ensuring the Future is Made in All of America by All of America's Workers](#) (86 FR 7475), it is the policy of the executive branch to use terms and conditions of Federal financial assistance awards to maximize, consistent with law, the use of goods, products, and materials produced in, and services offered in, the United States.

Consistent with the requirements of the Build America, Buy America Act (Pub. L. 117-58, Division G, Title IX, Subtitle A, November 15, 2021), no funding made available through this funding opportunity may be obligated for an award unless all iron, steel, manufactured products, and construction materials used in the project are produced in the United States. For additional information, visit NSF's [Build America, Buy America](#) webpage.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final annual project report, and a project outcomes report for the general public.

Failure to provide the required annual or final annual project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through [Research.gov](#), for preparation and submission of annual and final annual project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via [Research.gov](#) constitutes certification by the PI that the contents of the report are accurate

and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

VIII. Agency Contacts

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Daniel Andresen, telephone: (703) 292-2177, email: dandrese@nsf.gov
- James E. Fowler, telephone: (703) 2928910, email: jafowler@nsf.gov
- SHARMISTHA BAGCHI-SEN, telephone: (703) 292-8104, email: shabagch@nsf.gov
- Sharmini P. Boghos, telephone: (703) 292-8932, email: sboghos@nsf.gov
- Erik Brunvand, telephone: (703) 292-8950, email: ebrunvan@nsf.gov
- Varun Chandola, telephone: (703) 292-2656, email: vchandol@nsf.gov
- Damian Dechev, Program Director, CISE/CCF, telephone: (703) 292-8910, email: desc@nsf.gov
- Sheikh Ghafoor, telephone: (703) 292-7116, email: sghafoor@nsf.gov
- Heather Masson-Forsythe, telephone: (703) 292-4499, email: hmassonf@nsf.gov
- Sylvia J. Spengler, Program Director, CISE/IIS, telephone: (703) 292-7347, email: desc@nsf.gov
- Ann C. Von Lehmen, Program Director, CISE/CNS, telephone: (703) 292-4756, email: desc@nsf.gov
- Goli Yamini, Program Director, CISE/CCF, telephone: (703) 292-5111, email: desc@nsf.gov
- Danella Zhao, Program Director, CISE/CCF, telephone: (703) 292-4434, email: desc@nsf.gov

For questions related to the use of NSF systems contact:

- NSF Help Desk: 1-800-673-6188
- Research.gov Help Desk e-mail: rgov@nsf.gov

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

IX. Other Information

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at <https://www.grants.gov>.

About The National Science Foundation

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NS Proposal & Award Policies & Procedures Guide* Chapter II.F.7 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.

To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at <https://www.nsf.gov>

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **For General Information** (NSF Information Center): (703) 292-5111
- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**
 - Send an e-mail to: nsfpubs@nsf.gov
 - or telephone: (703) 292-8134
- **To Locate NSF Employees:** (703) 292-5111

Privacy Act And Public Burden Statements

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See [System of Record Notices, NSF-50](#), "Principal Investigator/Proposal File and Associated Records," and [NSF-51](#), "Reviewer/Proposal File and Associated Records." Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Policy Office, Division of Institution and Award Support
Office of Budget, Finance, and Award Management
National Science Foundation
Alexandria, VA 22314

[Vulnerability disclosure](#) | [Inspector General](#) | [Privacy](#) | [FOIA](#) | [No FEAR Act](#) | [USA.gov](#) | [Accessibility](#) |
[Plain language](#) |



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